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SOURCE FOR VAPOR DEPOSITION

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This invention relates to vapor deposition and more particularly to an improved source from which a relatively thick layer of molten material may be deposited by evaporation upon a surface to be coated.

In the prior art wherein a layer of molten material is to be deposited upon a surface by evaporation of the material from a source, difficulty has often been encountered when it becomes desirous to deposit relatively thick layers by the methods heretofore known. For example, vapor deposition of materials in the prior art has generally been performed by resistance heating of a wire filament of various configurations. Such a filament works well so long as relatively thin layers of material are deposited. When thick layers of material are required and the amount of material placed upon the wire filament is increased to accomplish this, it has been found that the material to be deposited upon becoming molten tends to fall or drop from the filament prior to evaporation thereof. This, therefore, limits the amount of material which may be placed upon the wire filament and in turn limits the thickness of the molten layer of material which may be deposited upon the desired surface. It has also been found in many instances that the thickness of the layer of material deposited upon the desired surface is not uniform.

A further consideration of prior art methods is that when evaporating from a wire filament or the like the vaporized material leaves the filament in a non-directional manner. Such evaporation tends to coat the interior surface of the chamber within which the evaporation is taking place, thus resulting in a great loss of material.

Accordingly, it is an object of the present invention to provide a source for vapor deposition of relatively thick layers of material upon a desired surface.

It is another object of the present invention to provide a source from which material may be evaporated to provide relatively thick layers thereof upon a desired surface and from which the material to be evaporated will not drop prior to evaporation thereof.

It is still another object of the present invention to provide a source from which material may be evaporated and which is capable of retaining large amounts of material and from which the material may be evaporated evenly over the surface upon which it is to be deposited.

A still further object of the present invention is to provide an improved source from which material may be deposited in substantially thick layers upon surfaces to be coated therewith which is adapted for production processes and which is rugged in construction.

Yet another object of the present invention is to provide a source from which material may be evaporated in a controlled and predetermined direction.

An improved source for vapor deposition of a material upon a surface to be coated therewith in accordance with the present invention comprises a member of heat conducting material having an orifice in the surface thereof which is disposed in a predetermined direction, at least one cavity is provided within said member for receiving a material which is to be deposited, the orifice and the cavity being in communication with each other.

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The novel features of the present invention are set forth in the appended claims. Further objects and advantages of the present invention will be better understood from the following description taken in connection with the accompanying drawings in which alternative embodiments of the present invention are illustrated by way of example. It is to be expressly understood however that the drawings are for the purpose of illustration and description only and are not intended as a definition of the limits of this invention.

Fig. 1 is a schematic diagram partly in cross section of one form of apparatus in which the present invention may be employed.

Fig. 2 is a top view of one embodiment of a container in accordance with the present invention.

Fig. 3 is a schematic diagram of a cover or cap for the container as shown in Fig. 2.

Fig. 4 is a cross sectional view of the container as illustrated in Fig. 2 taken about lines 4—4.

Fig. 5 is a schematic diagram partly in cross section illustrating the container as shown in Fig. 2 fully assembled and in operation.

Fig. 6 is a side view partly in cross section of an alternate embodiment of a container in accordance with the present invention.

Fig. 7 is a top view of the container of Fig. 6 illustrating the arrangement of cavities therein.

Fig. 8 is a cross sectional view of the container illustrated in Fig. 6 taken about the lines 8—8.

Referring now to the drawings wherein like reference characters designate like or corresponding parts throughout the various views, there is shown in Fig. 1 one form of apparatus for depositing a material such as molten metal upon the surface of a semiconductor body which is illustrative of the applicability of the present invention. For example, in forming a P–N junction upon a silicon semiconductor body in accordance with the method disclosed and claimed in Patent No. 2,789,068, issued April 16, 1957, to J. Maserjian, a silicon body is preheated to a temperature above the eutectic temperature of silicon and aluminum and a molten layer of aluminum is deposited upon the silicon surface. The heating of the body and the evaporation of the aluminum upon the surface thereof is performed in an inert atmosphere or a vacuum. The apparatus as shown in Fig. 1 may also be used to evaporate a metal such as gold upon the surface of a semiconductor body to provide an ohmic connection thereto. Although the applicability of the present invention will be discussed with respect to deposition of metal upon a silicon semiconductor body, it is to be expressly understood that many other materials may be deposited from the source of the present invention. An example of additional materials is compounds or oxides of various material, such as those used in lens coatings, surface protection and shadow casting for electron microscope work.

Referring now more particularly to Fig. 1, the apparatus for carrying out a process as described above is shown and comprises a vacuum chamber **11** defined by a bell jar **12**, and a base **13**, a port **14** communicates with the vacuum chamber **11** and is attached to a vacuum pump **15**. A resistance heating platform **16** is supported within chamber **11** by any means known to the art, not shown for purposes of clarity. Platform **16** is connected outside the vacuum chamber to a source of electrical energy **20** by means of leads **17** and **18**. The source of electrical energy **20** may be any type presently known to the art which is controllable for supplying a predetermined amount of electrical energy to platform **16** and is preferably of a type to supply a low current at high voltage. It may, for example, include an